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The Proturans from North Korea

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So far as known to us, only two contributions have hitherto been published to the knowledge of the proturan fauna of Korea. IMADATÉ (1966) made a report on the proturans from Kosi-gul Cave, Kangweon-do (=Kangwon), collected by the Koreo-Japanese joint party of the Speleological Survey in South Korea 1966. A single species, *Nipponentomon nippon*, was found at that time. This proturan was collected again, together with five other species, *Acerella shirampa* (=*Verrucoentomon shirampa*), *Yamatentomon takanawanum* (=*Filientomon takanawanum*), *Nipponentomon uenoi uenoi, Berberentulus morikawai* and *B. durumagi*, from the provinces of Kangwon-do and Pyongan-namdo by the preliminary survey of the Korean fauna, which was carried out by the Hungarian Natural History Museum in co-operation with the Zoological Research Institute of the Korean Academy of Sciences in 1970 (IMADATÉ, 1973).

The present paper deals with the result of our examination of a fresh collection of proturans made by SZEPTYCKI, one of the authors, in Kesong-si, Hamyong-pukto and Ryanggang-do through the co-operative zoological expeditions in 1971 and 1974 made by the Institute of Systematic and Experimental Zoology of the Polish Academy of Sciences and the Zoological Research Institute of the Korean Academy of Sciences.

The collection contains fourteen specimens and proves to comprise eight species including one new genus, two new species and two species new to Korea. Thus, four species are newly added to the six species previously known from this area. Seven of the ten species are the forms commonly found in the Japanese Islands. This fact suggests a close affinity of the Korean proturan fauna with the Japanese, though our knowledge of Korean proturans is still too incomplete to suffice for a precise analysis.

We wish to express our hearty thanks to the members of the zoological expeditions in co-operation between the Institute of Systematic and Experimental Zoology of the Polish Academy of Sciences and the Zoological Research Institute of the Korean

Academy of Sciences made in 1971 and 1974. We are also greatly indebted to Dr. Shun-Ichi UÉNO, National Science Museum (Nat. Hist.), Tokyo, for reading the manuscript, for giving us many valuable advice and criticism, and for taking trouble to publish the present paper.

The specimens used for the present study, including the holotypes, are to be deposited in the collection of the National Science Museum (Nat. Hist.), Tokyo, and also in the collection of the Institute of Systematic and Experimental Zoology of the Polish Academy of Sciences.

List of Collecting Sites

1. Mt. Chonma-san, the valley above Pagyon waterfall, Kesong-si; 7–VI–1974; deciduous forest mixed with pine; litter.
2. Mt. Nampotae-san, southern slope, about 2,100 m above sea level, Ryanggang-do; 8–IX–1971; mixed forest (*Larix, Betula,* etc.); under stone.
3. The slope of Susong-chon valley, west of Chongzin, Hamgyong-pukto; 22–V–1974; young pine forest, under growths of oaks and hazel; litter under hazel.
4. Chuul-onbo-ri, Hamgyong-pukto; 24–V–1974; humid gorge covered with deciduous forest; litter by bases of rocks.

Family Eosentomidae BERLESE, 1909

Eosentomon udagawai IMADATÉ, 1961

(Fig. 1)

Eosentomon udagawai IMADATÉ, 1961, Kontyû, Tokyo, **29**: 136–138; 1974, Protura, Fauna Japonica, 297–303.
Other references are not required here.

Specimen examined. 1♀, Chonma-san, Kesong-si, 7–VI–1974, collected by A. SZEPTYCKI.

Foretarsus 55 μm, abdominal terg. V–VI without A 3 and terg. VII without A 1 and 3. No significant difference is found between this and Japanese specimens.

Distribution. Japan and China; new to Korea. This is the first record of eosentomids from the Korean Peninsula. Compared with acerentomids, eosentomids seem remarkably few in this area. It is not known if this is merely due to the collecting technique or not.

Family Acerentomidae SILVESTRI, 1907

Yamatentomon yamato (IMADATÉ et YOSII, 1956)

Acerentulus yamato IMADATÉ et YOSII, 1956, Ins. Mats., **20**: 11–14.
Yamatentomon yamato: IMADATÉ, 1974, Protura, Fauna Japonica, 107–114.
Other references are not required here.

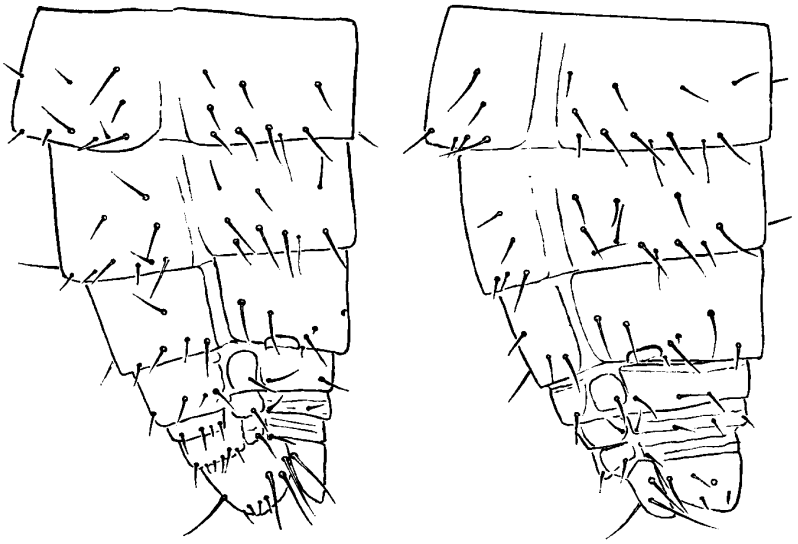

Fig. 1. *Eosentomon udagawai* from Chonma-san; abdomen VI–XII, latero-ventral (left) and latero-dorsal (right) views.

Specimens examined. 1 ♂ and 1 ♀, Susong-chon, Hamgyong-pukto, 22–V–1974, collected by A. SZEPTYCKI.

Foretarsus 104–105 μm, TR=2.5–2.6, BS=0.63–0.67. The Korean specimens examined are a little smaller than Japanese specimens, but all the specific features are not different between the two.

Distribution. Japan; new to Korea.

Nipponentomon nippon (YOSII, 1938)

Acerentmon nippon YOSHII (=YOSII), 1938, Zool. Mag., Tokyo, **50**: 398–400.

Nipponentomon nippon: IMADATÉ & YOSII, 1959, Contr. Biol. Lab. Kyoto Univ., (6): 24–30; IMADATÉ, 1966, Bull. Natn. Sci. Mus., Tokyo, **9**: 537–540, from Kosi-gul Cave (Kangwon-do); 1973, Ann. hist.-nat. Mus. hung., **65**: 151 & 152, from Kumgang-san (Kangwon-do); 1974, Protura, Fauna Japonica, 143–152.

Other references are not required here.

Specimen examined. 1 ♀, Chuul-onbo-ri, Hamgyong-pukto, 24–V–1974, collected by A. SZEPTYCKI.

Foretarsus 89 μm, TR=2.5, BS=0.73. As in the specimens from Kumgang-san (IMADATÉ, 1973), no significant difference from Japanese specimens is found.

Distribution. Japan and Korea.

Nipponentomon uenoi paucisetosum IMADATÉ, 1965

Nipponentomon uenoi paucisetosum IMADATÉ, 1965, Bull. Natn. Sci. Mus., Tokyo, **8**: 28–33 & 50; 1974, Protura, Fauna Japonica, 162–168.

Specimen examined. 1 ♂, Chuul-onbo-ri, Hamgyong-pukto, 24–V–1974, collected by A. SZEPTYCKI.

Foretarsus 92 μm, BS=0.73. The Korean specimen agrees with Japanese ones in most of the important characters, but the former is different from the latter in the absence of accessory setae P 3a on abdominal terg. I–VII. It seems likely that the difference suffices for a recognition of a new subspecies, if it is geographically fixed. For the time being, we tentatively regard it as an individual variation within *N. uenoi paucisetosum*, leaving a final decision for future investigations.

Distribution. Japan; new to Korea. The nominate subspecies, *N. uenoi uenoi*, has been recorded from Kumgang-san, Kangwon-do, by IMADATÉ (1973).

Berberentulus morikawai (IMADATÉ et YOSII, 1956)

Acerentulus morikawai IMADATÉ et YOSII, 1956, Ins. Mats., **20**: 14–16.
Berberentulus morikawai: TUXEN, 1963, Ent. Medd., **32**: 97; 1964, Protura, Paris, 314–316; IMADATÉ, 1973, Ann. hist.-nat. Mus. hung., **65**: 151 & 152, from Sagam-po (Pyongan-namdo) and Kumgang-san (Kangwon-do); 1974, Protura, Fauna Japonica, 195–204.
Other references are not required here.

Specimen examined. 1 preimago (♂), Chonma-san, Kesong-si, 7–VI–1974, collected by A. SZEPTYCKI.

In the preimago specimen examined, P 2a on abdominal terg. VI is absent on both sides, and P 1a′ between P 1a and P 2 is found on one side of the tergite. This must be due to an individual abnormality. Foretarsus 76 μm, TR=3.6, BS=0.44 and the ratio of P 2 to P 1a on abdominal terg. VI=9.5.

Distribution. Japan, Formosa, Korea and China.

Berberentulus tosanus (IMADATÉ et YOSII, 1959)

Acerentulus tosanus IMADATÉ et YOSII, 1959, Contr. Biol. Lab. Kyoto Univ., (6): 20–21.
Berberentulus tosanus: TUXEN, 1963, Ent. Medd., **32**: 97; 1964, Protura, Paris, 318; IMADATÉ, 1974, Protura, Fauna Japonica, 204–212.
Other references are not required here.

Specimens examined. 1 ♀, Nampotae-san, Ryanggang-do, 8–IX–1971, collected by A. SZEPTYCKI; 2 ♂ and 3 ♀, Susong-chon, Hamgyong-pukto, 22–V–1974, collected by A. SZEPTYCKI.

Foretarsus 66–80 μm, TR=3.5–3.8, BS=0.46–0.50 and the ratio of P 2 to P 1a on abdominal terg. VI<7.1. No significant difference is found between these and Japanese specimens.

Distribution. Japan and Formosa; new to Korea.

Berberentulus samchonri IMADATÉ et SZEPTYCKI, sp. nov.

(Figs. 2–3, 5 G)

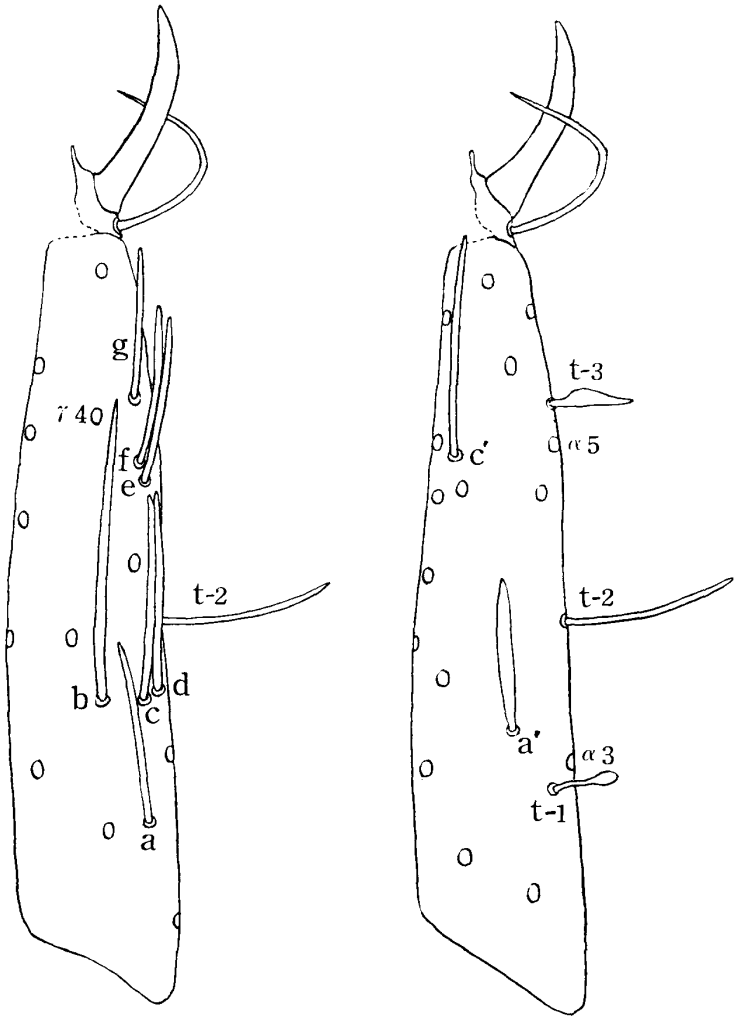

Fig. 2. *Berberentulus samchonri* sp. nov.; foretarsus, exterior (left) and interior (right) views.

Body length about 1,060 μm in the holotype.

Mouthparts small, sensillae on maxillary palpus slightly broadened, sensilla on labial palpus broadened; pseudoculus almost circular, 8 $\times$8 μm; canal of maxillary gland of a normal shape, its proximal part rather short.

Foretarsus 77 μm in length, claw with no inner flap; TR=3.7; empodium short, EU=0.1; position and shape of foretarsal sensillae similar to those of *B. izumi*. Dorsal sensilla *t*–1 claviform, proximal (not distal) to α3, BS=0.4; *t*–2 thin; *t*–3 relatively long and sword-like. Exterior sensilla *b* slightly broadened and extremely long, its apex slightly surpassing the base of γ4; *c* situated close to *d*, at about halfway between α3 and *t*–2; *c* and *d* subequal in length; *e* very close to *f* and subequal to *f* in length; apices of *e* and *f* not surpassing the base of γ5; *g* not surpassing the tarsus. Interior sensilla *a'* broad and located a little distal to α3; *b'* absent; *c'* thin and its apex slightly surpassing the tarsus.

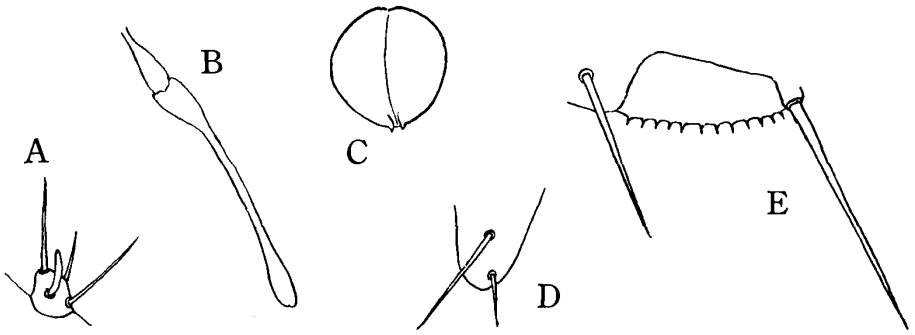

Fig. 3. *Berberentulus samchonri* sp. nov. —— A, Labial palpus; B, canal of maxillary gland; C, pseudoculus; D, abdominal appendage III; E, comb on abdomen VIII.

Table 1. Chaetotaxy of *Berberentulus samchonri*.

	Dorsal		Ventral	
Thorax I	4	1, 2	4–4	A 1, 2, M 1, 2
			6	P 1, 2, 3
II–III	6	A 2, 4, M	7–2	A c, 2, 3, 4, M
	16(14)	P 1, 1a, 2, 2a, 3, 4, 5, (5a)	4	P 1, 2
Abdomen I	4	A 1, 2	3	A c, 2
	12	P 1, 1a, 2, 2a, 3, 5	4	P 1, 2
II–III	6	A 1, 2, 5	3	A c, 2
	16	P 1, 1a, 2, 2a, 3, 4, 4a, 5	5	P c, 2, 3
IV–V	6	A 1, 2, 5	3	A c, 2
	16	P 1, 1a, 2, 2a, 3, 4, 4a, 5	8	P 1, 1a, 2, 3
VI–VII	8	A 1, 2, 4, 5	3	A c, 2
	16	P 1, 1a, 2, 2a, 3, 4, 4a, 5	8	P 1, 1a, 2, 3
VIII	6–8	A 1, 3, 5, M 1, 2, 3, 4	4	1, 2
	8	P 2, 3, 4, 5	0	
IX	14	1, 2, 3, 3a, 4, 4a, 5	4	
X	12	1, 2, 3, 3a, 4, 5	4	
XI	6	1, 2, 3	6	
XII	9		6	

Chaetotaxy (Table 1) similar to that of *B. tosanus*, but on abdominal terg. VII four pairs of anterior setae, A 1, 2, 4 and 5, present. Abdominal appendages II–III with two setae each, the apical one less than half the subapical. The striate band on abdomen VIII reduced, no distinct striae; comb on terg. VIII consisting of about 12 teeth; female squama genitalis with pointed acrostylus.

Holotype: ♀, Susong-chon, Hamgyong-pukto, 22–V–1974, collected by A. SZEPTYCKI. The only exsisting specimen, the holotype, is to be deposited in the collection of the National Science Museum (Nat. Hist.), Tokyo.

Notes. The present new species is distinctive in a peculiar combination of several important features such as the position of foretarsal sensillae *t*–1, *c, d, e* and *f* as well

as the absence of foretarsal sensilla *b'* and the presence of A 1 on abdominal terg. VII among the members of *Berberentulus*. *B. izumi* IMADATÉ from Japan is similar to the present new species in the position of foretarsal sensillae *t*–1, *c, d, e* and *f,* but the former has sensilla *b'* on its foretarsus and only two pairs (A 4 and 5) of anterior setae on abdominal terg. VII. Foretarsal sensilla *f* is very long, its apex surpassing the tarsus, and one pair of accessory setae, P 1a, is absent on abdominal terg. I–VI, in the former.

The specific name, *samchonri*, means Korea, a poetical expression in the Korean language.

Genus ***Chosonentulus*** IMADATÉ et SZEPTYCKI, nov.

Type-species: *Chosonentulus chosonicus* IMADATÉ et SZEPTYCKI, sp. nov.

Diagnosis. Similar in general appearance to *Berberentulus*; mouthparts small; labial palpus with one broad sensilla and three setae; canal of maxillary gland with racemose appendices, its proximal part rather short.

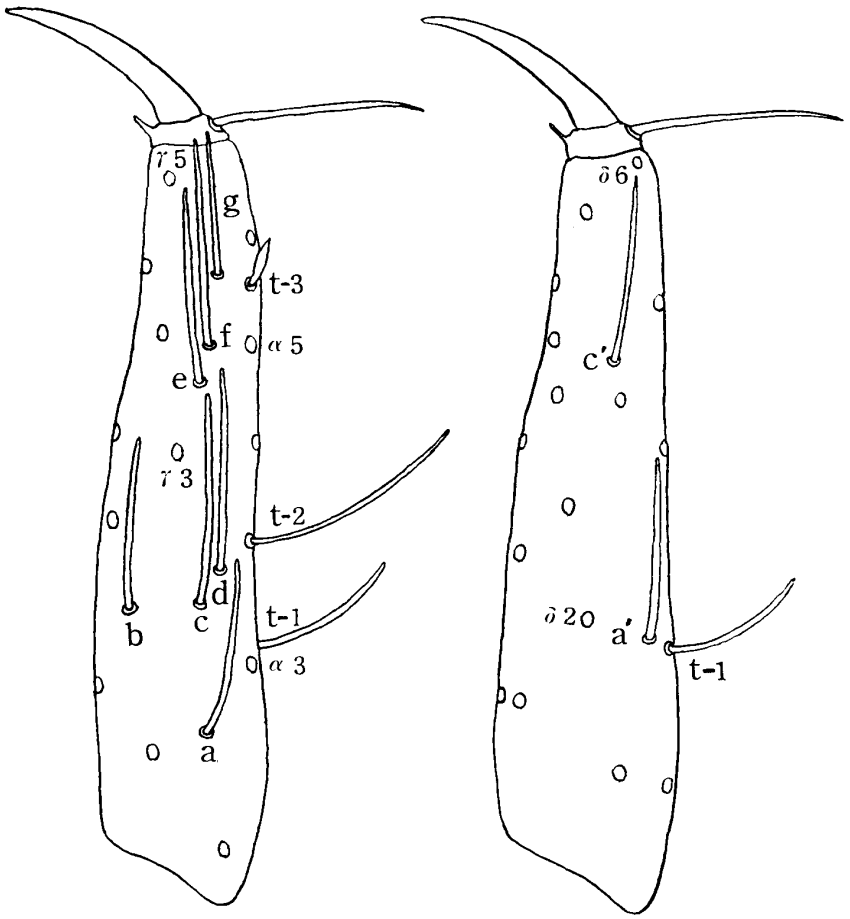

Fig. 4. *Chosonentulus chosonicus* gen. et sp. nov.; foretarsus, exterior (left) and interior (right) views.

Foretarsal sensilla *t*–1 filiform; *b* in row with *c*; *d* close to *c*; *e* nearer to *f* than to *d*.

Thoraces II and III with two pairs, A 2 and 4, of dorsal anterior setae; P 3 on abdominal terg. II–VI anterior to the other posterior setae; all the tergal accessory setae sensilla-like, not seta-like; stern. I–VII with three anterior setae, A c and 2. Abdominal appendages II–III with two setae each, the apical one about half the subapical. The striate band on abdomen VIII reduced, no distinct striae, but its anterior edge with minute serration.

Notes. Although only a single specimen is known, it seems sufficient for the establishment of a new genus on the basis of the peculiar combination of *Berberentulus*-features and filiform *t*–1. The shape of canal of the maxillary gland and the minute serration on the striate band on abdomen VIII are also peculiar among the members of *Berberentulus* and its allies.

"Choson" is a synonym of Korea in the Korean language.

Chosonentulus chosonicus IMADATÉ et SZEPTYCKI, sp. nov.

(Figs. 4, 5 A–F, 6)

Body length about 800 μm in the holotype.

Mouthparts small, sensillae on maxillary palpus slightly broadened, sensilla of labial palpus broadened; pseudoculus shorter than broad, 7 μm in length, PR=16.5; canal of maxillary gland with racemose appendices, its proximal part rather short.

Foretarsus 77 μm in length, claw with no inner flap; TR=3.5; empodium short, EU=0.1. Dorsal sensilla *t*–1 filiform, not claviform, a little distal to α3, BS=0.58; *t*–2 thin; *t*–3 small. Exterior sensilla *b* short, its apex slightly surpassing the base of γ3; *c* situated in row with *b*, and longer than *b*; *d* close to *c* and subequal to *c* in length; *e* nearer to *f* than to *d*; apices of *f* and *g* surpassing the tarsus. Interior sensilla *a'* slightly distal to *t*–1; *b'* absent; *c'* thin, its apex not surpassing the base of δ6.

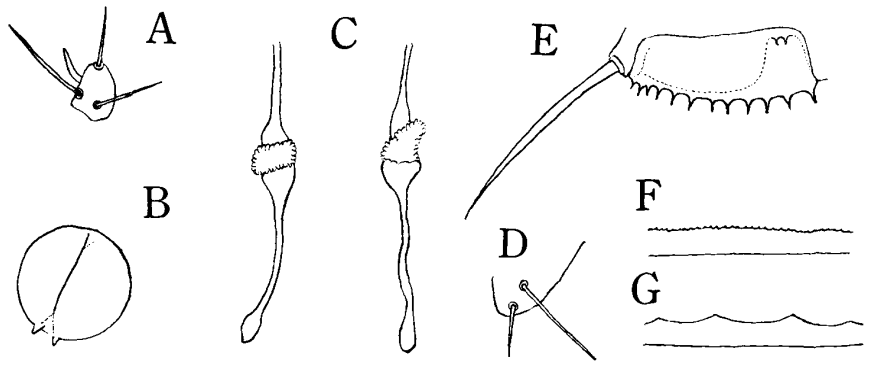

Fig. 5. A–F. *Chosonentulus chosonicus* gen. et sp. nov. —— A, Labial palpus; B, pseudoculus; C, canal of maxillary gland; D, abdominal appendage III; E, comb on abdomen VIII; F, striate band on abdominal terg. VIII. —— G. *Berberentulus samchonri* sp. nov.; striate band on abdominal terg. VIII.

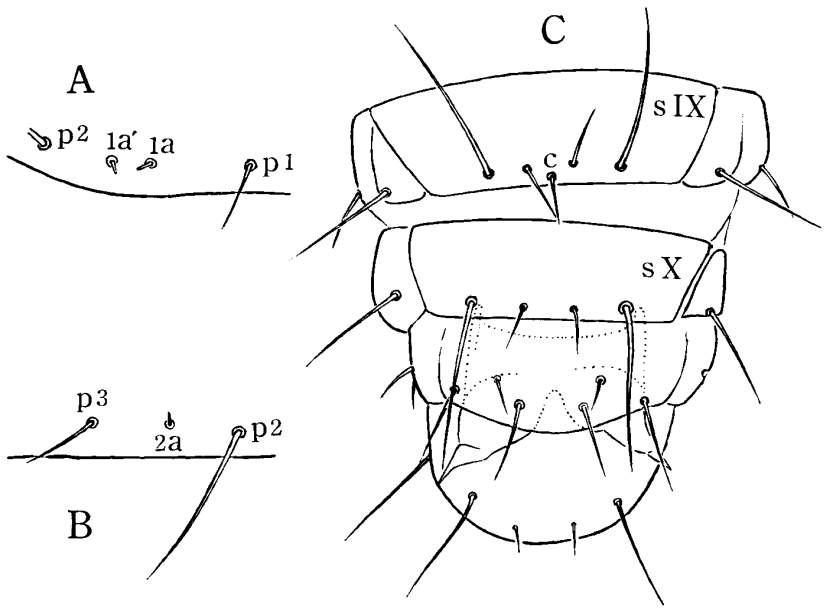

Fig. 6. *Chosonentulus chosonicus* gen. et sp. nov. —— A, Posterior margin of thorax II, dorsal view; B, posterior margin of abdominal terg. I; C, abdomen IX–XII, ventral view.

Table 2. Chaetotaxy of *Chosonentulus chosonicus*.

		Dorsal		Ventral	
Thorax	I	4	1, 2	?	
	II	6	A 2, 4, M	?	
		16	P 1, 1a, 1a′, 2, 2a, 3, 4, 5		
	III	6	A 2, 4, M	7–2	A c, 2, 3, 4, M
		14	P 1, 1a, 2, 2a, 3, 4, 5	4	P 1, 2
Abdomen	I	6	A 1, 2, 5	3	A c, 2
		12	P 1, 1a, 2, 2a, 3, 5	2	P 1
	II–III	6	A 1, 2, 5	3	A c, 2
		16	P 1, 1a, 2, 2a, 3, 4, 4a, 5	5	P c, 2, 3
	IV–VI	6	A 1, 2, 5	3	A c, 2
		16	P 1, 1a, 2, 2a, 3, 4, 4a, 5	8	P 1, 1a, 2, 3
	VII	6	A 2, 4, 5	3	A c, 2
		16	P 1, 1a, 2, 2a, 3, 4, 4a, 5	8	P 1, 1a, 2, 3
	VIII	6–8	A 1, 3, 5, M 1, 2, 3, 4	4	1, 2
		8	P 2, 3, 4, 5	0	
	IX	14	1, 2, 3, 3a, 4, 4a, 5	5	c, 1, 2
	X	12	1, 2, 3, 3a, 4, 5	4	
	XI	4	2 3	6	
	XII	9		6	

Chaetotaxy (Table 2) similar to that of *Berberentulus*-species. Thoraces II–III with two pairs of anterior setae, A 2 and 4. On thorax II an extra pair, P 1a′, of dorsal posterior setae present between P 1a and P 2. Abdominal terg. II–VI with

three pairs of anterior setae, A 1, 2 and 5; terg. VII with A 2, 4 and 5; on terg. XI only two pairs of setae, 2 and 3, present and setae 1 absent; all the tergal accessory setae sensilla-like. Abdominal stern. I–VII with three anterior setae, A c and 2; stern. IX with five setae, c, 1 and 2. Abdominal appendages II–III with two setae, the apical one about half the subapical. The striate band of abdomen VIII reduced, no distinct striae, but its anterior edge with minute serration; comb on terg. VIII consisting of about ten small teeth with a few extra teeth on the anterior part; female squama genitalis with pointed acrostylus.

Holotype: ♀, Susong-chon, Hamgyong-pukto, 22–V–1974, collected by A. SZEPTYCKI. The holotype is to be deposited in the collection of the National Science Museum (Nat. Hist.), Tokyo.

Notes. Since the holotype is the only known specimen, it could not be determined whether the features such as the presence of dorsal P 1a′ on thorax II and of c on abdominal stern. IX are individual variation or not.

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